Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Phase Diagram of the Bose Hubbard Model with Weak Links KALANI HETTIARACHCHILAGE, VALY ROUSSEAU, KA-MING TAM, JUANA MORENO, MARK JARRELL, DANIEL SHEEHY, Department of Physics and Astronomy, Louisiana State University, Baton Rouge, Louisiana 70803, USA — We study the ground state phase diagram of strongly interacting ultracold Bose gas in a one-dimensional optical lattice with a tunable weak link, by means of Quantum Monte Carlo simulation. This model contains an on-site repulsive interaction (U) and two different near-neighbor hopping terms, J and t, for the weak link and the remainder of the chain, respectively. We show that by reducing the strength of J, a novel intermediate phase develops which is compressible and non-superfluid. This novel phase is identified as a Normal Bose Liquid (NBL) which does not appear in the phase diagram of the homogeneous bosonic Hubbard model. Further, we find a linear variation of the phase boundary of Normal Bose Liquid (NBL) to SuperFluid (SF) as a function of the strength of the weak link. These results may provide a new path to design advanced atomtronic devices in the future.

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Date submitted: 12 Dec 2011 Electronic form version 1.4